Zero Retries issue 0090 2023-03-17

Zero Retries is an independent newsletter about technological innovation in Amateur Radio. Zero Retries promotes Amateur Radio as (literally) a license to experiment with radio technology.

About Zero Retries

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Request To Send

Scratching Itches

My primary observation about this edition of the Zero Retries Omnibus of Zero Retries Interesting Information is that Amateur Radio doesn't lack for individual Amateur Radio Operators who want to develop *their own flavor of low power High Frequency (HF) radios*. From my perspective, low power HF radios are a well-solved problem (many times over), but apparently there are

itches regarding low power HF radios that haven't yet been scratched.

This is especially true if you factor in the *plethoric abundance* of affordable Software Defined Receivers and Transceivers. It's rare that a SD Receiver or Transceiver isn't capable of operating on HF frequencies.

Given the power, abundance, and low cost of SD Receivers and Transceivers, the easiest path to making one's ideal radio would seem to be to write your own software that looks and works as *you* imagine, desire, and prefer.

"A simple matter of software", even for those of us who are not otherwise capable of writing software doesn't seem to be nearly as much of an obstacle as it used to be.

Most of the "hard work" of interfacing a general software framework to the particular hardware of a Software Defined Radio unit… is generally "off the shelf" thanks to the nearly universal imperative of "first, write support for GNU Radio".

The User Interface *is the Radio*

Thus getting a Software Defined Radio unit to work and look like the radio that *you* want is actually the task of writing the *user interface*. This can be as (conceptually) simple as pointing the money gun at a competent programmer and telling her how you want *your* radio to work, and look. She builds some demo screens and you discuss what you like and don't like. Once the two of you arrive at something that looks like what you want, then remains the work of hooking the user interface to GNU Radio in the background.

Sound easy, except your money gun is pretty empty? Not to mention that those competent programmers are already very busy and demand a higher price than you can fill your money gun? Well, the rise of the bots may be the solution. It's feasible… soon… that AI can write code. Thus I can imagine that not only will we have highly customized radio stations… soon enough we'll have highly customized *radios*.

de Steve N8GNJ

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Zero Retries 0090 Omnibus of Zero Retries Interesting Information

By Steve Stroh N8GNJ

The Zero Retries Omnibus is a highly subjective… index… of items I find Zero Retries Interesting, published every fifteenth issue of Zero Retries. Everything listed there has some relevance to what I try to discuss every week in Zero Retries - generally… technological innovation in Amateur Radio. I refer to the most recent Omnibus constantly, often in response to an email query about some subject mentioned in Zero Retries and asked for a pointer to learn more.

As I write this, the Zero Retries 0090 Omnibus of Zero Retries Interesting Information has grown to 12,323 words from the previous edition's (Zero Retries 0075) 11,754 words.

New or substantially updated entries in this edition are prepended with the word **New0090**. Thus it was easy to do a quick search to see how many new entries there are in this edition - merely *34*; the previous edition had 86 new entries. Thus if you've read previous editions of the Omnibus, you can skip to the new entries - just search for **New0090**.

What follows are some highlights of items added or updated in the Zero Retries 0090 Omnibus.

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ARDC Grants

> **New0090** Enhancing HF Digital Voice with FreeDV - Improvements to FreeDV including speech quality and low(er) signal-to-noise operation.

Even if it weren't the only ARDC grant that has publicly been disclosed since the previous edition, it merited mention. I think this project will pay significant dividends into Amateur Radio. One criticism I hear (from a knowledgeable source) about some Amateur Radio open source software is that it's not written in a manner to be easily understood, and it's generally undocumented or poorly documented. That's a disincentive for companies to use it to add "open source features" - in this case, FreeDV1, to their products. Thus this grant, enabling the use of professional software developers, may be able to develop highly portable, and well-documented code for FreeDV to be embedded into more Amateur Radio systems.

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Learning Radio Technology and Software Defined Radio

Media - Books

> **New0090** Exploring Software Defined Radio (featuring Raspberry Pi Projects)

New0090 Media - Classes / Tutorials

> Getting Started with Radio Frequency Applications - Microchip University
>
> ScratchRadio - Uses the Scratch visual programming language on Raspberry Pi to teach Software Defined Radio technology - Lime Microsystems.

Interesting Projects in Development

> **New0090** hz.tools - Project by Paul Tagliamonte K3XEC to create his own Software Defined Radio stack and accompanying tutorial. Useful because of K3XEC's "single person perspective".

These are a few resources that offer an approachable (more than the usual textbook / college course / GNU Radio project) introduction to radio technology and software defined radio technology.

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Interesting Projects In Development

> **New0090** All-In-One-Cable (AIOC) - A radio / computer interface using USB-C providing audio interface / push-to-talk circuit, and programming circuit. Prior to this project, the former and latter functions were separate units.

This was such a refreshing idea that solves multiple layers of aggravation to connect a radio to a computer:

- Physical connection(s) of the radio - the connectors.
- Voltage of the radio's interface - RS-232C? 5 volts? 3.3 volts?
- Audio interface specifics - audio out on tip? audio in on ring? etc.
- What does the radio require for Push To Talk to work… and presenting a standard-enough PTT interface to the computer so software can switch the radio from receive to transmit.
- Increasingly, new computers only offer USB-C so you need *yet another adapter* to accommodate USB-C.

Previously those functions were disparate, and this project combines all of that into one unit - *brilliant*!

> **New0090** - Rhizomatica Mercury - A configurable open-source software-defined modem used in the HERMES system from Rhizomatica (see above) that incorporates Orthogonal Frequency Division Multiplexing (OFDM) techniques.

Mercury is one of the first (that I'm aware of) open source implementations of OFDM techniques. This implementation was well-proven in its use in the HERMES system, and the creators stated that it can be scaled up to use wider bandwidth available on VHF / UHF. At the moment, Mercury is "just a block of modem code" and thus will require considerable work to make it usable.

…

Networking - LoRa

> **New0090** Austin Mesh - City-wide text messaging system based on LoRa technology.

This is one of the more interesting implementations of LoRa technology by hobbyists using license-exempt, rather than Amateur Radio spectrum. I expect this will be cloned in a number of cities where there is a substantial population of techies.

…

Networking - VHF / UHF - Hardware - Radios

New0090 [New Packet Radio] NPR units assembled:

- Elekitsorparts (labeled FUNtronics) - NPR-70 v05 Modem by F4HDK.
- Localino - New Packet Radio Modem Version 2, NPR-H 2.0; includes an integral 7 watt transmitter.

The Localino Version 2 unit makes NPR a lot more practical; you don't have to "treasure hunt" the specific portable radio power amplifier known to work with NPR and you have one piece of hardware to deal with; add enclosure, power, Ethernet, and antenna and you're on the air with New Packet Radio.

…

Software Defined Receiver / Transmitter / Transceiver (VHF / UHF / Microwave)

New0090 RFzero - Arduino-based Software Defined Transmitter.

RFzero is significant because it was the first (that I'm aware of) unit that eschews the integration of a receiver and the resulting simplification of no receiver circuitry or transmit / receive switching. We have ample Software Defined Receivers; now we finally have a Software Defined Transmitter and we can combine the transmit and receive functions of a radio with software integration.

…

Satellite / Space (one of the "big three" raison d'êtres of Zero Retries)

New0090 NPR-VSAT - Adaptation of New Packet Radio to provide TCP/IP services for QO-100.

Until I read about this, it didn't occur to me that there *weren't* TCP/IP services available through QO-100. This now seems like a natural development, and this concept seems very well-considered.

…

Special Categories

New0090 - RNode - Open, free and unrestricted digital radio transceiver. It enables anyone to send and receive any kind of data over both short and very long distances. RNodes can be used with many different kinds of programs and systems, but they are especially well suited for use with the cryptographic networking stack Reticulum.

RNode and Reticulum seem like "down the rabbit hole", incredibly powerful technologies that transcend Amateur Radio.

…

Speculative Ideas

New0090 - Pacsat Broadcast Protocol Concept for transmit constrained email, bulletins, files, etc.

This concept… *from 1990…* just seems prescient. Imagine every urban area having a one transmitter using the Pacsat Broadcast Protocol - it would be *the* information resource for the entire Amateur Radio population. Combine the ideas outlined here with current inexpensive, powerful technologies such as Software Defined Receivers, embedded computers such as Raspberry Pi, and techniques (that used to be computationally expensive) such as Forward Error Correction, Orthogonal Frequency Division Multiplexing, etc.

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Observations on Radio Frequency Interference

By Alexander von Obert DL4NO

Alexander von Obert DL4NO provided this feedback to my article The Inevitability of Digital Everything in Amateur Radio in Zero Retries 0086. DL4NO granted me permission to run this as an article in Zero Retries.

Most noise is distributed along power lines and other conductors, *not* through the air! Therefore it is extremely important to keep that noise away from the RX input. In many cases this is very easy to do - and I know what I am talking about: Put current chokes

on the antenna cable at least on both ends! For explanations see below.

About RFI: I gathered lots of experience in this field when I built my shortwave mobile station. For example see https://www.dl4no.de/thema/mobilbe0.htm, picture at the bottom: This mag mount has about 100 pF of capacity to the roof of the car. From 20m up, this is enough to operate without problems. But the “ground” of the antenna is “warm” because of the voltage divider between the (untransformed, very low) source impedance of the antenna and the capacity of the mag mount. If you have no current choke where I have it, you get the following signal path:

- In the car, RFI is coupled to the outside of the antenna cable.
- At the mag mount, this RFI creates a voltage across the mentioned capacity.
- This voltage reaches the inside of the cable shield and therefore the RX input!

You have similar problems with about all antennas. An obvious example are Windom antennas that are not center fed in the voltage knot of the dipole. This is how I cope with this problem (bottom):

Image courtesy of Alexander von Obert DL4NO

BTW: The two blue ferrite rings form an experimental 1:4 balun made from current chokes. The final version is here: https://www.dl4no.de/thema/14-balun.htm, including a description of the underlying theory.

The Windom antenna is disguised in a traffic noise protection wall, otherwise I could not have built a reasonable 80m antenna - a typical NVIS system. All my antennas are at the back end of my garden, about 10m away from all houses.

Together with an OM in Maryland I am doing tests on 40m using this antenna. I can often hear KM4UDX, see https://www.qrz.com/db/KM4UDX - homemade QRP at its best.

Compare that to OH8STN who has problems with the same line of solar controllers [YouTube] that I use. In the video he desperately tries to close holes while ignoring the biggest of all: the RX input! I have two of these solar controllers in active service, even much stronger ones - up to 500 W. I have two voltage inverters fed from the same battery as my IC-705. One needed a common current choke for the two 12 V wires. But I hear absolutely nothing of my solar emergency power supply.

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ZR > BEACON

XHDATA D-219 Short Wave Radio Receiver

Image courtesy of xhdata.com.cn

The XHDATA D-19 Short Wave Radio Receiver looks like most other inexpensive consumer-grade broadcast radio receivers, right down to the mechanical tuning indicator. But as Jenny List explains in her Hackaday review, there is no (conventional) analog radio circuitry in this radio - *all* the radio functions are performed with a Silicon Labs Si4825. I thought it was unusual to *mimic* the look and feel of an "analog" radio, but as List explains, that mimicry is the raison d'être of the Si4825 - it has no *digital* inputs, only varying voltage inputs for tuning and band selection. The best thing about this radio is that the cost is < *$10.00!*

AREDN Slack Group

Orv Beach W6BI on (several AREDN-related mailing lists):
There are various AREDN groups scattered around the webiverse. They meet the needs of their users, but we felt there was a need for one consolidated global meeting area where meshers from all areas could exchange ideas and compare approaches.

A Slack workgroup has been created to meet that need. Here's an invite link.

That invite is good for 30 days [from 2023-02-27].

Hope to see you there!

Modern Ham YouTube Channel

YouTube's algorithms suggested a new channel in my feed - Modern Ham, by Billy Penley KN4MKB. The first video I saw was promising - Ham Radio Local Area Network via New Packet Radio. Most of the videos to date are Zero Retries Interesting, so I'm now a subscriber, and Modern Ham is now noted in Closing the Channel as one of the recommended YouTube channels.

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Feedback Loop

Feedback via email:

- **Re: Zero Retries 0088** - Remote Mounted Microwave Software Defined Transceivers - Martin Rothfield W6MRR:
    - *Regarding [improvements to] GNU Radio, one suggested idea was giving GNU Radio the ability to generate HDL [Hardware Description Language] (used to generate FPGA bitloads) directly from GNU Radio Companion flow graphs. This wouldn't be science fiction, just hard work from skilled hands.*
    - You might be interested in this project that involves remotely mounted Software Defined Receivers - Raspi Wideband Receiver.
- **Re: Zero Retries 0087** - ARISS Announcements at Hamcation 2023 (DATV) - Ren Roderick K7JB:
  The TechMinds YouTube has a series going about Digital Amateur TV:

  THE ULTIMATE DATV & SSB QO-100 Transceiver Build - Part 1

  Interesting watching his progression as he is setting up his new stuff.

If you provide feedback via email, I may excerpt your feedback or include it in full. Unless you specifically grant me permission to include your name, I won't do so. Feedback may be lightly edited for clarity.

Join the *Fun* on Amateur Radio

If you're not yet licensed as an Amateur Radio Operator, and would like to join the fun by *literally having a license to experiment with radio technology*, check out
Join the Fun on Amateur Radio for some pointers.

Zero Retries Frequently Asked Questions (FAQs) - In development 2023-02.

Closing the Channel

In its mission to highlight technological innovation in Amateur Radio, promote Amateur Radio to techies as a literal license to experiment with radio technology, and make Amateur Radio more relevant to society in the 2020s and beyond, Zero Retries is published via email and web, and is available to anyone at no cost. Zero Retries is proud *not to participate* in the Amateur Radio Publishing Industrial Complex, which hides Amateur Radio content behind paywalls.

My ongoing ***Thanks*** to:

- Tina Stroh KD7WSF for, well, *everything!*

- **Pseudostaffers** Dan Romanchik KB6NU and Jeff Davis KE9V for continuing to spot, and write about "Zero Retries Interesting" items on their blogs that I don't spot on my own.
- **Newsletters** that regularly feature Zero Retries Interesting content:
    - Amateur Radio Weekly by Cale Mooth K4HCK is a weekly anthology of links to interesting Amateur Radio stories.
    - Experimental Radio News by Bennet Z. Kobb AK4AV discusses (in detail) Experimental (Part 5) licenses issued by the US FCC.
- **YouTube channels** that regularly feature Zero Retries Interesting content:
    - HB9BLA Wireless by Andreas Spiess HB9BLA
    - KM6LYW Radio by Craig Lamparter KM6LY (home of the DigiPi project)
    - Modern Ham by Billy Penley KN4MKB
    - Tech Minds by Matthew Miller M0DQW
- The Substack email publishing platform makes Zero Retries possible. I recommend it for publishing newsletters.

If you're reading this issue on the web and you'd like to see Zero Retries in your email Inbox every Friday afternoon, just click below to join ~~100~~ ~~200~~ ~~300~~ ~~400~~ *~~500~~* ~~600~~ *700+* other readers:

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If you're a fellow smart person that uses **RSS**, there *is* an **RSS feed for Zero Retries**.

Zero Retries (N8GNJ) is on Mastodon - n8gnj@mastodon.radio - just click:

Zero Retries / N8GNJ on Mastodon

Email issues of Zero Retries are "instrumented" by Substack to gather basic statistics about opens, clicking links, etc.

More bits from Steve Stroh N8GNJ:

- SuperPacket blog - *Discussing new generations of Amateur Radio Data Communications - beyond Packet Radio (a precursor to Zero Retries)*
- N8GNJ blog - *Amateur Radio Station N8GNJ and the mad science experiments at N8GNJ Labs - Bellingham, Washington, USA*

Thanks for reading!
Steve Stroh N8GNJ / WRPS598 (He / Him / His)
These bits were handcrafted (by a mere human, not an Artificial Intelligence bot) in beautiful Bellingham (The City of Subdued Excitement), Washington, USA.

2023-03-17

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[1]

In stating this, I'm not applying that observation to FreeDV (I'm not qualified to make that judgment).